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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/967,141	09/28/2001	John D. Acton	P6196 US	4926

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EXAMINER	
BAKER, STEPHEN M	
ART UNIT	PAPER NUMBER
2133	

DATE MAILED: 06/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/967,141	ACTON, JOHN D.	
	Examiner	Art Unit	
	Stephen M. Baker	2133	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-32 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-4 and 7-32 is/are rejected.

7)☒ Claim(s) 5 and 6 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 2.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 10-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 10: "first interface" is inconsistent with the terminology used later in dependent claim 16, and "a extended" is apparently a typographical error. The claim apparently should be amended as follows:

> 10. A data processing system, comprising:
> a first data interface for receiving data segments;
> an error correction code (ECC) generator connected to the first data interface for generating an ECC corresponding to each of the data segments received by the first interface, said ECC providing at least one-bit error correction capability, each of the data segments and the corresponding ECC forming an extended data segment;
> an exclusive-or (XOR) module connected to the ECC generator for performing XOR calculations on the extended data segments to generate a an extended parity segment, said extended parity segment comprising a parity segment and a parity ECC; and
> an ECC check module connected to the XOR module for recalculating a new ECC for each extended data segment and comparing the new ECC to the original ECC corresponding to that extended data segment, wherein for each extended data segment, if the new ECC does not match with the original ECC, said ECC check module is configured to restore the data segment using the original ECC.

In claim 18: a software program is apparently recited without specifying a machine-readable medium therefor. The claim apparently should be amended as follows:

> 18. An article of manufacture comprising a machine-readable medium including code for operating a data processing system, wherein the code causes operations to be performed comprising:
> receiving a plurality of data segments;
> for each of the plurality of data segments, generating an error correction code (ECC) corresponding to the data segment, said ECC providing at least one-bit error correction capability; and
> calculating an extended parity segment from the plurality of data segments and the corresponding ECCs, said extended parity segment comprising a parity segment calculated from the plurality of data segments and a parity ECC calculated from the corresponding ECCs.

In claims 19, 21 and 24-26: necessary mention of code to perform the recited steps has apparently been omitted. The claims apparently should be amended as follows:

> 19. The article of manufacture of claim 18, further comprising code causing operations to be performed comprising:
> for each of the plurality of data segments:
> recalculating a new ECC corresponding to the data segment;
> comparing the new ECC with the original ECC for the corresponding data segment; and
> if the new ECC does not match with the original ECC for the corresponding data segment, then restoring the corresponding data segment based on the original ECC.

> 21. The article of manufacture of claim 19, further comprising code causing an operation to be performed comprising:
> for each of the plurality of data segments, if the new ECC does not match with the original ECC for the corresponding data segment and the data segment cannot be restored based on the original ECC, then generating a signal indicating a data integrity error.

24. The article of manufacture of claim 18, further comprising code causing an operation to be performed comprising:

transmitting each of the plurality of data segments and the parity segment to a non-volatile storage device.

25. The article of manufacture of claim 18, further comprising code causing an operation to be performed comprising:

generating a write request from a host computer, said write request including a unit of data to be stored; and dividing the unit of data into a plurality of stripe sub-units;

wherein each of said plurality of data segments comprises a portion of one of the plurality of stripe sub-units.

26. The article of manufacture of claim 18, further comprising code causing operations to be performed comprising:

using the parity segment to calculate a new parity ECC;

comparing the new parity ECC with the parity ECC contained within the extended parity segment; and

if the new parity ECC does not match with the parity ECC contained within the extended parity segment, then restoring the parity segment based on the parity ECC contained within the extended parity segment.

In claim 27: "first interface" is confusingly used to refer to two different interfaces, and a period is used where a semicolon is appropriate. The claim apparently should be amended as follows:

27. A storage system, comprising:

a front end interface for receiving the data segments;

a controller bus connected to the ~~first data~~ front end interface;

at least one storage device;

a back end interface connected to the controller bus and the at least one storage device, said back end interface for receiving the data segments from the ~~first data~~ front end interface via the controller bus and passing the data segments to the at least one storage device~~.~~;

a ~~first~~ controller interface connected to the controller bus for receiving data segments;

an error correction code (ECC) generator connected to the ~~first~~ controller interface for generating an ECC corresponding to each of the data segments received by the ~~first~~ controller interface, said ECC providing at least one-bit error

correction capability, each of the data segments and the corresponding ECC forming an extended data segment;

an exclusive-or (XOR) module connected to the ECC generator for performing XOR calculations on the extended data segments to generate a extended parity segment, said extended parity segment comprising a parity segment and a parity ECC; and

an ECC check module connected to the XOR module for recalculating a new ECC for each extended data segment and comparing the new ECC to the original ECC corresponding to that extended data segment, wherein for each extended data segment, if the new ECC does not match with the original ECC, said ECC check module is configured to restore the data segment using the original ECC.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 7 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 4,993,030 to Krakauer *et al* (hereafter Krakauer).

Krakauer discloses a RAID system with stripes encoded by a (7, 4) Hamming single-error correction code, generating three stripes of ECC parity from four stripes of data (Fig. 14). Each stripe is subsequently encoded with "parity or error correction codes" (col. 15, lines 1-4) in the control units for the respective paths, where each stripe corresponds to a path. With reference to the language of the claims, units forming

each of the four data stripes collectively provide a "data segment" and corresponding units forming the Hamming code stripes provide "ECC ... corresponding to the data segment". The parity or ECC coding performed on each stripe individually provide an "extended parity segment comprising a parity segment calculated from the plurality of data segments and a parity ECC calculated from the corresponding ECCs".

5. Claims 1-4 and 9 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,526,538 to Hewitt (hereafter Hewitt).

Regarding claim 1: Hewitt discloses a decoding arrangement for an (8, 4)×(8, 4) "modified Hamming" product code. Encoding the product code involves encoding rows and columns (see col. 2, lines 6-13) of a 4x4 data bit (D) array to form three Hamming code bits (E) plus a single parity bit (P) covering both the data bits and Hamming code bits. With reference to the language of the claims, each row (or column) of the 4x4 data bit array accordingly provides a "data segment" and the corresponding extended Hamming code bits (E, P) for each row (or column) provide "ECC ... corresponding to the data segment". The remaining extended Hamming code bits for the columns (or rows) conversely provide an "extended parity segment comprising a parity segment calculated from the plurality of data segments and a parity ECC calculated from the corresponding ECCs".

Regarding claims 2 and 3: Hewitt's steps (Fig. 6a) of computing the Hamming code syndrome and of parity error checking of received hard decisions involve "recalculating a new ECC" and "comparing the new ECC with the original ECC" for each

respective "segment". Hewitt's step of inverting the appropriate (*i.e.* syndrome-indicated) bit is "restoring the corresponding data segment" in the case of a single error.

Regarding claim 4: Hewitt's subsequent recognition of a condition wherein a second check (PARITY) recognizes additional error serves as a step of "generating a signal indicating a data integrity error".

Regarding claim 9: Hewitt performs steps of "using the parity segment to calculate a new parity ECC and comparing the new parity ECC with the parity ECC contained within the extended parity segment" in likewise decoding the columns (or rows) described above as providing the "extended parity segment".

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 7, 18-21, 24 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hewitt.

Regarding claims 18-21 and 26: Hewitt does not disclose whether the logic operations of encoding are performed under software control. Official Notice is given that the usefulness of software (i.e. convenience, low cost, ease of distribution and modification, hardware design simulation, etc.) in implementing logic operations was well known at the time the invention was made. It would have been obvious to a person

having ordinary skill in the art to implement the logic operations of Hewitt's encoding by means of software. Such an implementation would have been obvious because the usefulness of software in implementing logic operations was already well known.

Regarding claim 7 and further regarding claim 24: Hewitt does not disclose storing the product coded data in a nonvolatile storage, although the received product code is stored. Official Notice is given that the reliability advantage of nonvolatile storage for retaining data and instructions in the event of power failure was well known at the time the invention was made. It would have been obvious to implement Hewitt's storage of product coded data by using a nonvolatile storage device. Such an implementation would have been obvious because the reliability advantage of nonvolatile storage was already well known.

8. Claims 1, 7, 8, 18, 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,737,344 to Belser *et al* (hereafter Belser).

Belser discloses a single disk drive that uses software for RAID-like encoding of a group of disk drive data sectors (blocks) to generate a parity sector. Each sector, including the parity sector, is subsequently encoded with ECC parity. Belser does not disclose generating additional parity sectors for the set of disk drive data sectors. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to replace Belser's single parity sector (per data sector group) with an ECC coding arrangement having multiple parity sectors (per data sector group). Such a modification would have been obvious because both types of codings were already well-known alternatives, as used in RAID systems.

Allowable Subject Matter

9. Claims 5 and 6 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. Claims 10-17 and 27-32 would be allowable if rewritten or amended to overcome the rejections under 35 U.S.C. 112, second paragraph, set forth in this Office action.

11. Claims 22 and 23 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen M. Baker whose telephone number is (703) 305-9681. The examiner can normally be reached on Monday-Friday (11:00 AM - 7:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert DeCady can be reached on (703) 305-9595. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Stephen M. Baker
Primary Examiner
Art Unit 2133

smb